Invertebrata

Tasmania's Invertebrate Newsletter

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Deadline

for the November *Invertebrata* is 27 October 2000

July 2000
No. 17

Invertebrata is produced by the Queen Victoria Museum and Art Gallery, Launceston, Tasmania.

We publish articles and short notes on all aspects of invertebrate biology and conservation in Tasmania.

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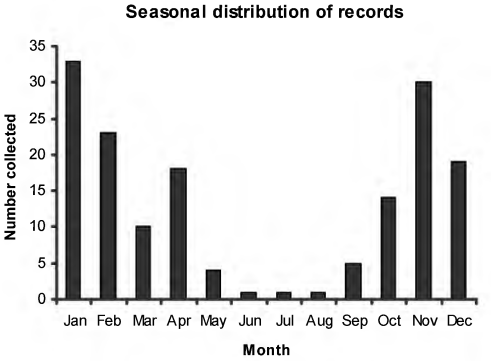
A study of the White-tailed Spider, *Lampona cylindrata*

Sharna Baylis & Susan Hurst

We are two grade 10 students from Riverside High School involved in a 'Science Stretch' program offered by the school. This program is designed for students in grades nine and ten who have an exceptional interest in science. Students work with scientists in industry and aquaculture and in university-based research. We volunteer in the Zoology Department of the Queen Victoria Museum and Art Gallery once a week where we have been working on a study of the White-tailed Spider, *Lampona cylindrata*.

The Zoology Department receives numerous inquiries from the public each year and of these inquiries about one third are spider-related. The White-tailed Spider is one spider commonly brought to the Museum for identification. Information for this study has been extracted from 20 years of records from public inquiries, (1980-1999). Only those records where a spider has actually been sighted and identified as a White-tailed Spider by the Zoology Department have been used. There were a total of 159 such records for this period. The month when the spider was collected is shown below.



From the seasonal distribution graph we can conclude that the spiders were most commonly collected from October to April and least often collected during the cooler winter months between May and September. A total of 66% (105) of the spiders were collected between November and February. This is consistent with the results of Platnick (2000) who found that adults have been collected all year round, but most abundantly in summer (November through February).

Most of the spiders, 86.2% (137), were collected from indoor locations, and only 14.8% (22) were either found outside or 'not known'. In 35.8% of cases (57), more

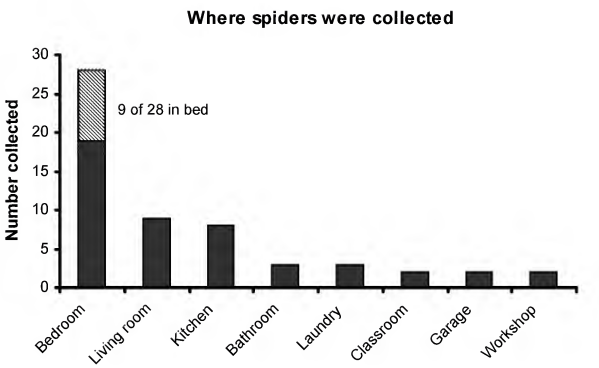
(continued on page 2)

(continued from page 1)

specific collecting information was available for the spiders found indoors. This information has been presented in the location graph (right).

According to Walker and Milledge (1992) the White-tailed Spider is commonly found in the bedroom. This was the most common indoor location where the spider was collected in this study. It is also interesting to note the number of these spiders that were found in beds. Other places inside where the spiders were found were on walls, windows, in jars, fireplace, floors, cupboard, wardrobes, shower recess, bathtub, sinks, amongst clothing, and under a magazine. Outside places included: amongst bricks, firewood, on walls, windows and in the garden.

Doran (1996) gives reasons why people tend to find White-tailed Spiders in their houses during the summer months. During this time the spiders are looking for a mate, and somewhere to lay their eggs. They are also searching for food, feeding on other species of spiders, especially the Black House Spider, *Badumna insignis*. Because of their wandering habits, White-tailed Spiders can turn up in a variety of places even in bedding and amongst clothing as this study has shown.



We would like to thank Judy Rainbird, of the Zoology Department at the Queen Victoria Museum and Art Gallery for her assistance and supervision of this study.

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More information:

Doran, N. 1996. The White-tailed Spider, *Lampona cylindrata*. Hobart: University of Tasmania (information sheet).

Platnick, N. 2000. A relimitation and revision of the Australian ground spider family Lamponidae (Araneae: Gnaphosidae) *Bulletin of the American Museum of Natural History* 245: 1-330.

Walker, K. and Milledge, G.A. 1992. *Spiders – Commonly Found in Melbourne and Surrounding Regions*. Melbourne: Royal Society of Victoria.

Note: This study demonstrates the importance of public inquiries to museums and the wealth of information that can be extracted from the many records that are received over the years. Recognising a need to be able to readily access this information, the Zoology Department of the Queen Victoria Museum has established a public inquiries database for the 500 or so public inquiries that are received each year, whether or not a specimen has been presented. In the past only those public inquiries that were accompanied by a specimen were well documented. This resulted in a great deal of otherwise valuable information either not being recorded or being difficult to retrieve.

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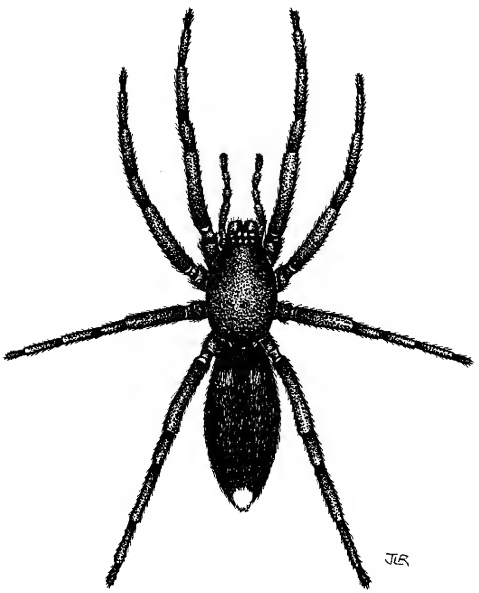

Lampona cylindrata (left), about 6 times life-size. Drawing by Judy Rainbird.

A new species of 'European' wasp in Tasmania

An unusual species of vespid wasp was captured in numbers in Malaise traps at the Warra LTER (Long Term Ecological Research) site in the Southern Forests near Tahune Bridge, west of Geeveston. The wasps were subsequently identified as the 'English wasp', *Vespula vulgaris* (L.). Examination of museum specimens showed that the wasp has been present in the Hobart area since 1995.

A survey was conducted by Forestry Tasmania staff throughout the State to determine the distribution of *V. vulgaris*. Several thousand vespid wasps were collected during April 2000 from 54 sites. The 'European wasp', *Vespula germanica*, was collected at most sites. *V. vulgaris* was collected at Hastings, Dover, Geeveston, Tahune, Lucaston, Crabtree, Tinderbox, Blackmans Bay, Kingston, Taroona, Mt Nelson and New Town. All of these localities are near or south of Hobart. There were no records of *V. vulgaris* from the north of the State.

On the mainland the English wasp has been present in the greater Melbourne region since 1958. Its distribution has remained mainly restricted to urban areas. A survey conducted this summer in the Melbourne area showed that numbers of *V. vulgaris* were very low and it was found at only one site (Oldina) in the Dandenong Ranges. The English wasp is naturally distributed in northern Europe and is active in colder, wetter conditions than *V. germanica*. This may explain its poor record in establishing on the Australian mainland. In New Zealand, *V. vulgaris* has replaced *V. germanica* in some areas.

The life history and behaviour of the two vespid species are similar, but because *V. vulgaris* has the potential to survive in wet forest areas, the species may be able to occupy niches currently marginal for *V. germanica* in Tasmania. Research at Warra has shown that *V. vulgaris* can penetrate further into closed-canopy old-growth forests than *V. germanica* and is a threat to the ecology of those sites.

Studies on the impacts of both wasp species on populations of native invertebrates will continue at Warra next season.

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Abdominal markings of *Vespula germanica* (left) and *V. vulgaris* (right).
From New, T.R. 1996. *Name That Insect. A Guide to the Insects of Southeastern Australia*. Melbourne: Oxford University Press.

Editorial

There are some interesting numbers lurking behind the '17' in *Invertebrata* 17.

Beginning with *Invertebrata 1* in the Spring of 1994 we've published 150 pages (A4 or equivalent) of news, queries and comment on Tasmanian invertebrates. Those items were supplied by more than 50 different contributors. We have our regulars, like the indefatigable Liz Turner (three items this issue!), but many of the most interesting items have been one-off's provided by enthusiastic specialists. May both their tribes increase.

Invertebrata is currently distributed to nearly 200 people outside QVMAG and to a number of institutional libraries. The Tasmania:mainland:overseas breakdown is 102:71:23. On the north island, Queensland has the most subscribers and WA has the fewest. The USA leads the overseas list with eight copies, and one copy each is sent to Austria, Argentina, Canada, Germany, the Netherlands and South Africa to keep those nations informed about matters invertebrate in Tasmania.

This is also my tenth issue as editor. I confess to enjoying the job, and I have only two minor regrets. The first is my continuing failure to persuade contributors of the importance of graphics, especially pictures. Readers want to know what the animal you're writing about *looks like*. Besides, as isopod enthusiast Glen Ingram likes to point out, invertebrates are stunningly beautiful. FLAUNT THEM.

My second minor regret is that we've so far been unable to put *Invertebrata* on an active QVMAG website. When that eventually happens, all past issues will be online and indexed by subject (at least), and contributors will be able to add colour stills, animations, video and sound to their articles.

Until then, read and enjoy the hard copy. If you know of anyone who should be added to our mailing list, let us know. Subscriptions are free but we greatly appreciate donations to help cover our costs.

The saga of 'Squidly'

Between June and November 1999, the Zoology Department of the Tasmanian Museum and Art Gallery received three specimens of the giant squid, *Architeuthis dux*. These were placed in cold storage awaiting possible future dissection. One specimen arrived the day before the June Environmental Expo at the TMAG and was placed on public display for a day, recording the highest hourly rate of public attendance on record for the TMAG.

A story by the ABC's *The 7.30 Report* sent our squid international and alerted the British film company *UK Productions,* who decided to include the squid in their upcoming documentary about giants within groups of animals. *Discovery Channel* will screen the series in Australia at the end of the year.

A financial and operational agreement was worked out for TMAG staff to take one of our giant squid to Cloudy Bay, Bruny Island, to simulate a stranding. The logistics of transporting a quarter of a tonne of thawing, smelly, slippery 'blubber' from Hobart to Cloudy Bay and into the sea were quite a challenge. Also needed was the construction of a high scaffolding tower for overhead filming. On Thursday, 2nd March 2000, in 30+°C heat, the expedition set out with three vehicles including a utility loaded with ice, kindly donated by *AquaTas*, and a 4WD with a trailer filled with squid, tarpaulins and scaffolding.

Before continuing any more of the saga, it must be stated that the whole venture was an outstanding success, and the blowflies loved every minute of it.

We took two squid in the end, making up half a tonne in weight. Unbeknownst to us, the first squid (245 kg) had been originally frozen in two pieces before donation and these fell apart on thawing. So on the actual day we had to load up another one, still frozen and weighing 255 kg, to be pliable by the same afternoon! Fortunately the very hot day helped considerably, causing the Bruny Island ferry to be rather messy and smelly by the time we drove off. Giant squid have a natural ammonia smell and a lot of liquid.

As the *Discovery* crew did not want to start filming until 6 pm (best light for them), Kathryn and Debby hauled the still partly frozen squid around in the sea in a tarpaulin during the afternoon to help thaw it out, while Paul and Mike built the high scaffold tower.

It must be confessed that 'Squidly' (the name evolved) looked totally authentic by the time she was set up on the turning tide with some strategic kelp, just as if she had washed up there. We knew Squidly was a female because two clumps of thread-like sperm packages had been impregnated into her skin, one in an arm and the other in the mantle fold. These were filmed by the crew, but we used the other squid's head for close ups of the beak and eyes. Squidly is one of only two mated females known by the TMAG to be caught in Tasmanian waters.

It was about 30°C most of the afternoon, with a stormy atmospheric sky and a spectacular sunset. The actual filming went perfectly, with the wild, deserted beach and magnificent coastal scenery as backdrop. Moving a 255 kg squid around is very hard work, but a specially-made sling with handles helped the six or more people needed to move her. The real winners of the day were the clouds of blowflies.

The *Discovery* team invited us to their rented house later that evening for celebrations, and at midnight we wound our way happily back to the miniature log cabin a colleague had lent us for the night. We sat round the campfire until early morning, physically fending off voracious possums (one mistook Debby's big toe for something tasty and drew blood).

The squid rode back on the ferry covered in ice, by now steadily dripping very smelly rivulets across the decks. The amount of fluid that leaks out is hard to believe. In the way that garlic is not noticeable if all present has eaten it, the smell of giant squid has the same effect on all those who are in actual contact with it. This meant we were happily immune, but other ferry passengers hurriedly wound up their car windows. The two squid were then taken to the TMAG Wet Store and preserved.

Altogether, a good time was had by all, and the *Discovery* crew were ecstatic. We left them still on the island looking for giant leeches in the rainforest on Mt Mangana. Rather them than us. Giant squid may be smelly and heavy, but they do not suck blood!

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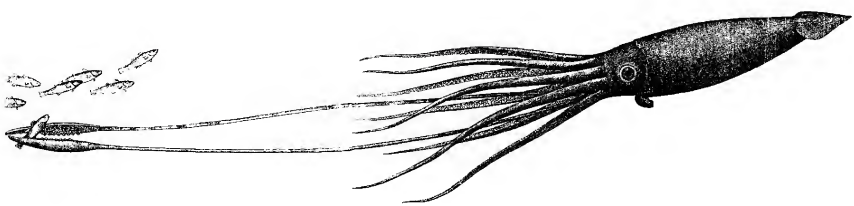

Completion of the 'Invertebrate site register' project in Tasmania for the Australian Heritage Commission in April 2000

This project was part of an Australia-wide effort, instigated by officers of the Australian Heritage Commission, to test the applicability to invertebrates of the criteria used for entry of a place on the National Estate Register. Suggestions of suitable sites for listing were to be sought from the whole community of Australian invertebrate specialists and 10 sites were to be selected in each State. Only already published work was to be used to validate invertebrate values and no new collections were to be made.

For the Tasmanian portion of the project, the AHC specifically requested that no sites in the World Heritage Area be selected, since this area was already receiving adequate attention. Altogether about 70 specialists, who had experience of Tasmanian invertebrates, were consulted and around 40 sites were proposed by them for the State. Guidelines used in making the selection of sites were that the higher taxa represented on them should have a high diversity and/or level of endemism within Tasmania. Also, the list should represent the major vegetation types and important invertebrate habitats in the State. However, vegetation types or taxa which were considered to be already receiving sufficient conservation attention at the time were not included.

It was considered important by the AHC to raise awareness of invertebrate conservation amongst the wider public so three recreation parks were included in the list and, where possible, everyone with local knowledge of any site was contacted to provide information on the nomination. The importance for invertebrates of even fairly small sites was also to be taken into account so, throughout the project, emphasis was given to naturally or artificially fragmented habitats. The sites for which nominations were prepared are listed in Table 1 and a summary of the taxa involved and of the land tenures and vegetation types of each site are given in Table 2.

The first five taxa listed in Table 2 display overall a particularly high level (over 90%) of Tasmanian endemism fulfilling one of the aims of the project. State Forest is the most common land tenure of the nominated sites which reflects the fact that a large proportion of forested land in Tasmania is devoted to forestry. Apart from the absence of alpine heath, that is already well reserved, and native grassland, the vegetation types included approximately reflect the relative dominance of the different plant communities in Tasmania excluding the World Heritage Area.

The final two nominations were submitted by the end of April this year. The next step in the process is for the Australian Heritage Commission to assess them and submit them to the Commissioners for acceptance when they are placed on an interim list for public comment. Listing on the National Estate Register does not confer legal protection to a site but it does draw the attention of land managers and government agencies to its heritage values and hence 'flag' it as worthy of protection. A number of sites have already been listed for invertebrate values in Victoria, South Australia, New South Wales and the Australian Capital Territory. As a result of the listings, there are examples of improvement in management for invertebrate values and prevention of inappropriate developments on these sites. Another benefit is, that in some cases, applications for funding for survey work have been successful because they were supported by an existing listing. The result has been new distributional records of what were previously considered rare taxa.

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Table 1.

Site	Taxa	Land tenure
1. Lauderdale Tip	*Amelora acontistica* *Dasybela achroa*	City Council
2. Weavers Creek	Six species of Diplopoda	State Forest
3. Mt Elephant velvet worm habitat	Blind Velvet Worm Giant Velvet Worm	State Forest
4. Cataract Gorge Cliff Grounds Reserve & Trevallyn State Rec. Area	*Neopseudogarypus scutellatus* *Mygas plomleyi* *Pasmaditta jungermanniae* *Australotomurus tasmaniae*	City Council
5. Burgundy Snail forests, Murdunna, Forestier Peninsula	*Helicarion rubicundus*	State Forest
6. Spider Den, North Lune, East Lune karst area	High diversity of troglodytic invertebrates	State Forest
7. Surveyors Creek	*Engaeus spinicaudatus*	State Forest
8. Simons Road Pink Springtail site	*Tasphorura vesiculata*	State Forest
9. Ferngladе Reserve earthworm site, Burnie	High diversity of terrestrial Oligochaeta	City Council
10. Savage River Pipeline Road invertebrate site	High diversity, type locality; Symphyla, Collembola, Pauropoda	State Forest

Table 2.

Taxa (no. sites)	Tenure (no. sites)	Vegetation (no. sites)
Mollusca (1)	State Forest (7)	Eucalypt forest (3)
Oligochaeta (1)	Local Council (3)	Rainforest (3)
Crustacea (1)		Sedgeland (1)
Onychophora (1)		Woodland (4)
Myriapoda (1)		Samphire (1)
Collembola (1)		Cave in eucalypt forest (1)
Lepidoptera (1)		Heathland in gorge (1)
Cave fauna (1)		
High diversity (1)		
Type locality (1)		
Totals (10)	(10)	(14)

Springtail (Collembola) from the Savage River Pipeline Road site. From a painting by Georgina Davis.

Hellyer's cicada

By process of elimination, I believe the cicada sketched by Henry Hellyer (*Invertebrata 11*) was the Tasmanian Hairy Cicada (*Tettigarcta tomentosa*), especially as it was mentioned that it was 'moth-like'. Hellyer more than likely would have been familiar with the 'typical' cicada shape that is predominant throughout all the cicadas, regardless of size or sound emitted. However, the hairy cicada doesn't have that look.

Another point to consider is that there was no mention of it making any sound, which also points to the Hairy Cicada.

Another possible cicada for the area is the Red Eye (*Psaltoda moerens*), but if it were the Red Eye, the eye colour would certainly have been mentioned. The eyes and distribution of *Cicadetta abdominalis* suit the description, but this cicada is very black in colour and it doesn't resemble 'a large Moth', as described by Hellyer.

My second choice of a possible candidate could be *Cicadetta torrida*, the most widely spread cicada in Tasmania, but I would be interested to know what other readers thought.

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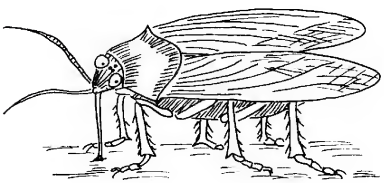

Cicada sketched by Henry Hellyer, Burnie, 3 August 1827. From p. 45 in *H. Hellyer's Journal of operations in opening a Road from Emu Bay towards the Hampshire Hills*, a manuscript in the University of Tasmania Archives. Reproduced through the courtesy of the Archives and Brian Rollins.

Tettigarcta tomentosa. Drawing by G. Monteith from: CSIRO, *The Insects of Australia* (2nd ed.). Carlton: Melbourne University Press, 1991.

Buzzing around Tasmania

Survey of bumblebees helps monitor their spread in Tasmania

In January a colour pamphlet was produced for a public survey on bumblebees. Three hundred copies were delivered to each of 11 national parks around the State, and rangers were asked to hand them out regularly to tourists and bushwalkers. Pamphlets were also distributed to 240 volunteer fire brigades, all Landcare groups, the Weed Alert Network, visitors to the Tasmanian Museum and Art Gallery and members of the public (on request). Following media coverage, many people rang the Museum to report sightings of bumblebees. More than 200 returns have been received so far.

Bumblebee population density is highest in suburban southern Tasmania, but the insects have been sighted from as far away as Smithton, Strahan, St Helens, Port Arthur and the South West National Park. Although bumblebees are still absent from Launceston, they are now present on Maatsuyker Island off the southern coast. A queen flew off a boat at Pedra Branca, but was not expected to survive as few flowers grow on the island. Three other sightings were over open water in southern Tasmania. Ninety percent of non-confirmed sightings in national parks relate to a sole bee.

Roger Buttermore has made 100 nest boxes of treated pine fitted out with nesting material for placement this coming August in the Warra Long Term Ecological Research Site (**www.warra.com**). This is to determine whether bumblebees are overwintering in the area. If they are, they will be looking for nests in Spring and will be attracted to the empty boxes. A low settlement is expected of queens in the nests, which means a lot of boxes are required to get a statistically useful sample. Survival, growth and parasites and disease will be monitored in occupied nests.

Kaye Hergstrom has commenced monitoring bumblebee numbers at urban and native bush sites. She has been aided by Agricultural Science undergraduates from the University of Tasmania and participants from the University of the Third Age.

Roger and Kaye are looking at seed-set of the common heath *Epacris impressa* in the presence and absence of bumblebees. This plant was chosen because bumblebees had been recorded visiting the heath and had occasionally been observed nectar-robbing from those flowers (biting a hole through the outside of the flower to sip nectar without having to go inside), a behaviour which defeats the whole pollination strategy.

Stay tuned for the next exciting chapter of 'Buzzing around Tasmania'.

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Bumblebees: another exotic organism for Australia

After the Palaearctic large earth bumblebee *Bombus terrestris* (L.) first arrived in Tasmania in February 1992 (Semmens *et al.* 1993), the Department of Primary Industries and Fisheries (DPIF) actively promoted them as a good insect (e.g. Semmens 1995, Stacey 1997). DPIF staff claimed that this species prefers to forage on introduced plants rather than natives (Semmens 1995, 1996, Stacey 1997), and that it does not compete with other species of bees (Semmens 1995, Stacey 1997). Both of these claims were based on extrapolation of the situation in New Zealand to Tasmania.

This species was introduced to New Zealand in 1885, but since then has only been recorded foraging on 19 native plant species (Donovan & Macfarlane 1984). This, together with the low densities at which it occurs in New Zealand, led Donovan (1980) to conclude that any competition from *B. terrestris* on native flower-feeding animals was negligible. Semmens (1996) compiled a list of forage plants for this species in Tasmania, which also indicated that it foraged predominantly on introduced plants here. However, this list was the result of people telephoning Semmens with their sightings, and was therefore obviously biased towards garden plants because of the greater densities of people in gardens than native vegetation.

However, Hingston and McQuillan (1998a) revealed that *B. terrestris* forages heavily on native plants in areas within 5 km of suburbia, with 2150 sightings on 62 species from 20 families. The most heavily visited families, in terms of numbers of plant species, were Myrtaceae, Fabaceae and Epacridaceae, with *Bursaria spinosa* (Pittosporaceae) and *Banksia marginata* (Proteaceae) also receiving many visits. The broad foraging of *B. terrestris* allowed it to maintain successful colonies in a wide range of vegetation types near Hobart, from coastal heath, through sclerophyll forests, to subalpine shrubbery at an altitude of 1100 m. This foraging profile overlapped with that of all insect families which feed on nectar and/or pollen, all bee subgenera, and all nectarivorous birds which were encountered. This, along with its presence at densities comparable to that of the European honeybee *Apis mellifera* L., indicates that *B. terrestris* has enormous potential to impact on plants and their native pollinators as well as the honey industry.

An experiment on the impact of *B. terrestris* on the foraging behavour of two species of native megachilid bees on the flowers of *Gompholobium huegelii* (Fabaceae) found that the megachilids visited fewer flowers, and had shorter foraging bouts in the afternoon, in quadrats where *B. terrestris* also foraged (Hingston and McQuillan 1999). Hence, *B. terrestris* was displacing the native bees through resource competition. This may adversely affect the pollination of *G. huegelii*. The megachilids have pollen-carrying scopal hairs on their metasomal sterna which contact the anthers and stigma of the flower when a bee probes for nectar. In contrast, *B. terrestris* is glabrous in this region and is therefore less well suited to transporting pollen of this species.

Evidence of competition with a territorial colletid bee was also discovered (Hingston 1997). This bee, which is smaller than *B. terrestris*, attempted to drive the latter away from flowers of Fabaceae. However, this was largely unsuccessful, resulting in the colletid wasting time and energy in resource defence while also risking physical injury. Hence, the colletid incurred both a loss of resources to *B. terrestris*, as well as a loss in the time and energy available to gather these resources.

The second-most frequently visited flower by *B. terrestris* was *Epacris impressa* (Epacridaceae) (Hingston and McQuillan 1998a). However, it is unlikely to be an effective pollinator of these flowers, due to its habit of piercing the corolla to access nectar, thereby bypassing the anthers and stigma (Hingston and McQuillan 1998b). Therefore, contrary to claims by DPIF staff (Semmens 1995, Stacey 1997) *B. terrestris* is not ecologically benign in Tasmania.

An application has been made by Gosford Integrated Pest Management Services to import *B. terrestris* into the Australian mainland to enhance pollination of tomatoes in greenhouses. Such an introduction clearly poses a threat to mainland Australian ecosystems. Moreover, recent research indicates that native anthophorid bees are capable of enhancing pollination in greenhouse tomatoes (Hogendoorn *et al.* in press). In fact, the resultant increase in yield in the presence of the anthophorids (48.5-53.4%) was greater than that generally achieved in the presence of *B. terrestris* (20-30%) (Semmens 1995). Hence, the introduction of *B. terrestris* to the Australian mainland not only involves ecological risks, it may also be economically unnecessary.

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Donovan, B.J. 1980. Interactions between native and introduced bees in New Zealand. *New Zealand Journal of Ecology* 3: 104-116.

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Stacey, E. 1997. Humble bumble bee a welcome hard worker. *The Mercury* newspaper, 30 January 1997, p.9.

How to... ...find lots of useful things on the Net through the SASB

The Society of Australian Systematic Biologists Web site, www.science.uts.edu.au/sasb, includes a set of links pages which take you directly to a huge range of other Web sites. Compiled and maintained by Dr David Morrison (Dept. of Environmental Sciences, University of Technology, Sydney; davidm@science.uts.edu.au), the SASB links pages are one-stop-shops for zoologists, botanists, molecular biologists, museum curators, etc. We reproduce below (with permission) the general outline of the links, and selected items of particular interest to invertebrate zoologists. Check the links pages if you don't see a site that you think should be listed — we probably left it out to save space! Dr Morrison welcomes feedback from Invertebrata *readers.*

GENERAL SOURCES OF INFORMATION. **The Biodiversity and Biological Collections Web Server** (this WWW server is devoted to information of interest to systematists and other organismic biologists. The pages have information about specimens in biological collections; taxonomic authority files; directories of biologists; reports by various standards bodies (IOPI, ASC, SA2000, etc); an archive of the Taxacom and MUSE-L listservers; access to on-line journals (including Flora On-line); and information about biodiversity and collections oriented projects (MUSE and NEODAT), including index images to the Biological Image Archive); **A Biologist's Guide to Internet Resources** (this guide is intended for use as a handout for training in seminars, workshops, and user services supporting use of the Internet by biologists, and for personal use. It is a list of the main types of Internet resources available for biologists, updated more-or-less monthly); **The Internet Directory for Botany** [subject list] [alphabetical list] (these two WWW servers list sources for every conceivable type of information related to botany, including:- Arboreta and Botanical Gardens; Botanical Museums, Herbaria, Natural History Museums; University Departments and other Institutes; Biologists' Addresses; Botanical Societies and Organizations; Checklists and Floras, Taxonomic Databases; Images; Journals, Books, Literature Databases, Publishers; Listservers and Newsgroups. They are regularly updated); **BIOSIS Internet Resource Guides** (this WWW server contains information of interest to all biologists, but mainly zoologists, with particular emphasis on taxonomy & nomenclature, including nomenclatural services); **UCMP Subway Phylogenetics Resources** (this WWW server provides a list of sites useful for phylogeneticists, including:- Societies; Meetings; Publications; Databases; and Software); **Systematics Servers** (this WWW server provides a list of sites useful for (mainly plant) systematists, including:- Taxonomic and Phylogenetic Information; Phylogeny Software; Taxonomic Information on Specific Groups; Nomenclature; Interactive Identification Software; Collections Management and Inventory Software; Bibliographies; Resources for Plant Systematics; Floras, Atlases, and Specimen Catalogues Online); **Digital Taxonomy** (this WWW server presents a resource of information for biodiversity data management, mainly aimed at promoting the use of computers for handling biological software development projects. It provides a range of links on:- software, hardware, methodologies, standards, data sources, and projects related to biodiversity data management.)

AUSTRALIAN BIOLOGICAL SOCIETIES AND ORGANISATIONS. *Other Sites*: **Australian Community Biodiversity Network, FASTS Member Societies**. *Alphabetical List*: incl. **Australasian Pollination Ecologists Society**, **Australian Coral Reef Society**, **Australian Entomological Society**, **Australian Marine Sciences Association**, **Australian Society for Limnology**, **Australian Society for Parasitology**, **Council of Australian University Museums and Collections**, **Council of Heads of Australian Entomological Collections**, **Ecological Society of Australia**, **Entomological Society of Queensland**, **Entomological Society of Victoria**, **Malacological Society of Australasia**.

OVERSEAS SYSTEMATICS SOCIETIES AND ORGANISATIONS. Incl. **American Association for Zoological Nomenclature**, **American Association of Museums**, **Association of Systematics Collections**, **Classification Society of North America**, **Dutch Classification Society**, **European Association for Zoological Nomenclature**, **European Society for Evolutionary Biology**, **Evolution of Terrestrial Ecosystems Consortium**, **French Systematics Society**, **International Commission on Zoological Nomenclature**, **International Federation of Classification Societies**, **International Society for Biochemical Systematics**, **IUBS Taxonomic Databases Working Group**, **Willi Hennig Society**, **Linnean Society of London**, **Society of Systematic Biologists**, **Southern Connection**, **Specialist Group for Systematic and Phylogenetic Odonatology**, **Systematics Association**.

(AUSTRALASIAN HERBARIA AND BOTANIC GARDENS)
(AUSTRALASIAN MUSEUMS)
(AUSTRALIAN UNIVERSITIES)
(AUSTRALIAN GOVERNMENT DEPARTMENTS & AGENCIES)

DATABASES. *Animals*: incl. **Chalcid Wasps** (Arthropods Associated with Livestock Dung), **Entomology Library and Information Network**, **Hymenoptera On-Line**, **Orthoptera Species File**, **Threatened Animals of the World**, **World List of Insect Families**, **World List of Marine and Freshwater Crustacea Isopoda**, **World List of Terrestrial Isopoda**, **Zoological Record Taxonomic Hierarchy**. *Miscellaneous*: incl. **Environment Australia Environmental Databases**, **Fossil Record 2**, **Taxonomy Resource & Index To Organism Names**, **Tree of Life**, **UNESCO-IOC Register of Marine Organisms**, **World Biodiversity Database**.

COMPUTER SOFTWARE. *Other Sites*: **BioCatalogue** compilation of sequence-analysis software, **Guide to the Web for Statisticians** compilation of statistics software, **Hennig Society** compilation of phylogenetic software, **Internet Directory for Botany** compilation of biological software, **Joe Felsenstein** compilation of phylogenetic software, **Taxonomy and Systematics at Glasgow** compilation of phylogenetic software, **Tree of Life** compilation of phylogenetic software, **UCMP Subway** compilation of phylogenetic software. *Phylogeny Programs*: **AutoDecay**, **CAFCA**, **CAIC**, **Component**, **DCSE**, **Farside Programs**, **MacClade**, **PAUP**, **Phylip**, **Phylodendron**, **RASA**, **Spectrum**, **SplitsTree**, **TREECON**, **TreeView**. *Multivariate Programs*: **ADE-4**, **CANOCO**, **Cornell Ecology Programs**, **DECODA**, **MVSP**, **NTSYS-pc**, **PATN**, **PC-ORD**, **R Package**, **SYN-TAX**. *Miscellaneous Programs*: **Alice**, **BioLink**, **BIOTA**, **DELTA**, **FLORIN Information System**, **LucID**, **MEKA**, **NDE** Nexus Data Editor, **PANDORA**, **Platypus**, **Specify**, **TRANSLAT**.

SYSTEMATICS JOURNALS. *Other Sites*: **University Press Catalogues**, **Other Press Catalogues**, **Publishers' Catalogues Home Pages**. *Alphabetical List*: incl. **Annual Review of Ecology and Systematics**, **Australian Journal of Entomology**, **BIOSIS**, **Bulletin of Zoological Nomenclature**, **Cladistics**, **Evolution**, **Evolutionary Computation**, **Evolutionary Ecology**, **Global Ecology and Biogeography Letters**, **Invertebrate Taxonomy**, **Journal of Biogeography**, **Journal of Classification**, **Journal of Evolutionary Biology**, **Journal of Zoological Systematics and Evolutionary Research**, **Molluscan Research**, **New Entomological Taxa**, **Systematic Biology**, **Systematic Entomology**, **Systematic Parasitology**, **Taxon**, **Trends in Ecology and Evolution**, **Zoologica Scripta**.

MISCELLANEOUS RESOURCES. *Biogeography:* incl. **PaleoMap**, **Southeast Asia Plate Tectonics**, **Southwest Pacific paleogeography reconstruction**, *Directories*: incl. **Directory of UK Systematics Expertise**, **Global Directory of Marine (and Freshwater) Professionals**, **Taxonomic Resources and Expertise Directory - USA**, **World Taxonomists Database**. *Documents and Codes*: incl. **Association of Systematics Collections Information Modeling Project for Biological Collections**, **Compleat Cladist**, **Draft BioCode**, **International Code of Zoological Nomenclature**. *Networks and Services*: **Biodiversity Information Network**, **Biodiversity, Taxonomy and Conservation**, **Bioweb Biological Web Sites**, **European Science Foundation Systematic Biology Network**, **Expert Center for Taxonomic Identification**, **Integrated Taxonomic Information System**, **Internet Biodiversity Service**, **National Biological Information Infrastructure** (USA), **PaleoNet**, **UK Systematics Forum**, **World Conservation Monitoring Centre**, **Worldmap Biodiversity**. *Miscellaneous*: incl. **Beetles (Coleoptera) and Coleopterists**, **Coleoptera Homepage**, **Fleas (Siphonaptera)**, **Global Land Environments Since the Last Interglacial**, **International Committee on Bionomenclature**, **Recent and Fossil Bryozoa**, **Species 2000**.

(*Dare we say it? ...and much, much more...*)

Macquarie Harbour gives up some of its molluscan secrets

While conducting a survey of central Macquarie Harbour, west Tasmania, to collect baseline information on proposed marine farms in the area, Ron Mawbey (*ex* University of Tasmania) obtained two species of unusual-looking bivalve molluscs using a van Veen grab. Both species were collected on the 9th of February, 2000 at 25-40 m depth. Dr Graham Edgar (University of Tasmania) examined them and then passed them on to Liz Turner at the Tasmanian Museum. Richard Willan was contacted for advice when identification proved difficult, even after all available reference books had been checked.

The results were extremely interesting. The smaller of the two species is *Parathyasira resupina* Iredale, 1930 (Thyasiridae). This species is figured by Kevin Lamprell and John Healy in *Bivalves of Australia, Vol.2*. It is normally a deep water species found in New South Wales, though Dr Robert Burn has also identified them from Macquarie Harbour, where they were collected during the survey of heavy metal pollution by Connor *et al.* (1996). Ron Mawbey's specimens are therefore only the second known record of *P. resupina* from Tasmania (Tasmanian Museum Registration Number E23422) Grab samples collected elsewhere in Macquarie Harbour by Graham Edgar, Ron Mawbey and Derek Shields (Aquenal Pty Ltd) indicate that this species is the most abundant macroinvertebrate living in the Harbour at depths from 25 to at least 42 m (G. Edgar, *pers. comm.*).

The larger bivalves, an adult and a juvenile, are *Lucinoma eculia* (Cotton and Godfrey, 1938) (Lucinidae). The adult specimen measures 31 x 34 mm and the species is illustrated in *South Australian Mollusca* (Cotton 1961), fig. 261. Although *L. eculia* is considered a deep water species, the South Australian Museum has been cited by Cotton (1961) as holding an example from 50 fathoms off Marie (sic) Island, eastern Tasmania. However, this specimen was not located during a search of the S.A. Museum collection in May 2000. Thus the Macquarie Harbour specimens recorded from 34 and 39 m depth are the only available samples of *L. eculia* from Tasmania, and are interesting because they were collected in silt in much shallower water than mainland Australian sites. This is the first time that *L. euclia* has been recorded in the family Lucinidae (Tasmanian Museum Registration No. E23423). Previous records placed it in the family Veneridae.

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More information:

Cotton, B.C. 1961. *South Australian Mollusca. Pelecypoda*. Adelaide: Government Printer.

Lamprell, K., and Healy, J. 1998. *Bivalves of Australia. Vol.2*. Leiden: Backhuys Publishers.

O'Connor, N.A., Cannon, F., Zampatti, B., Cottingham, P. and Reid, M. 1996. *Mt Lyell remediation: A pilot biological survey of Macquarie Harbour, western Tasmania*. Supervising Scientist Report No. 113, 1-55.

Historical footnote

Was George Augustus Robinson a wannabe entomologist?

I have frequently pondered over the work of creation as connected with entomology, especially the busy and industrious ant of which there are many kinds, and were my mind disemburdened from the great anxiety which at present it is overwhelmed, I might find abundant food in this study for reflection. The other day whilst waiting the arrival of the people who was in the arrear, I observed an ant hill near where I stood and prompted by curiosity thought I would look into the subterraneous regions of this singular insect and observe its actions. I accordingly made a breach with a stick when the whole nation rose en masse and like a city in commotion, concentrating their forces and arms to aid this, as if in quest of the daring intruder. I saw them coming from under the arch or covered way and then returning by other tunnels to another part of their territory as if sounding the tocsin of alarm, and as if calling upon the rest to defend their country. Whilst reflecting upon this singular work of nature and standing unthinking with the stick in my hand by which I had made the perforation, an end resting upon the anthill, I was suddenly attacked by them and stung in my finger, the pain of which was so sudden and acute as caused me to drop suddenly the stick and which seemed to please a native who stood by and caused him to laugh heartily.

G.A. Robinson, 28 November 1831 (near Lake Echo)

from Plomley, N.J.B. 1966. *Friendly Mission: the Tasmanian Journals and Papers of George Augustus Robinson 1829-1834*. Hobart: Tasmanian Historical Research Association; p. 533.

Invertebrates in the media

4000 years of water in desert 'sea'

PERTH – *A massive underground inland sea big enough to supply Perth with water for the next 4000 years has been discovered below the parched West Australian outback.*

Water is perhaps Australia's most precious resource and the discovery could have huge economic significance in one of the driest parts of the continent.

Mining company Anaconda Nickel Ltd yesterday said it had ended a long search for a fabled inland sea in WA while searching for more water for its thirsty processing operations.

It said the underground water – estimated to be the equivalent of 4200 Sydney harbours – extended 700 km by 200 km in an area under the Officer Basin, northeast of Kalgoorlie.

Ranging between 50 m and 2000 m deep, the resource had an estimated total surface area of 200 000 sq. km., the company said.

While the water would be drinkable after processing, it was more likely to end up being used for mines and farms than being piped to households.

The Examiner newspaper, Launceston, 17 May 2000, p. 8.

Why is this an invertebrate story?

The answer has to do with stygofauna. *Stygobites* are animals which live only in subterranean waters. Many stygobites are crustaceans, but there are also aquatic mites, oligochaetes and fish that only occur underground.

For obvious reasons, stygobitic life has not been well studied. Many stygobites seem to feed on rotting material washed into underground passages. Individual species are rarely abundant, but overall species diversity can be surprisingly high, particularly in limestone karst areas.

The underground world has been described as 'the world's most extensive terrestrial ecosystem, occurring in all climatic zones and ranging from the tops of mountains to 120 m below sea level' (Humphreys 1999, p. 224). Some underground regions are species-poor, others are species-rich. One of the richest is in Western Australia.

It isn't clear why WA has come to have such a diverse stygofauna. One possibility is that many of the species are descendants of animals that lived in and near Tethys, the ocean that separated Gondwana and Laurasia after the breakup of the Pangaea supercontinent. This appears to be true for some of the WA species in the karst of Barrow Island and the Cape Range peninsula. These 'Tethyean' species have their closest relatives in caves in eastern North America and the Caribbean.

The story seems to be a bit different for the freshwater aquifers of inland WA. Here the faunas are best described as pangean or gondwanan relicts. They include some very odd animals, indeed, which are only just becoming known to zoology.

This puts the '4000 years of water' story in a different light. Imagine an above-ground network of lakes full of endemic, relictual species. A plan to drain the lakes would be strongly opposed. The species living in the WA aquifers also deserve protection:

> *These relictual lineages are best conserved by protecting their habitat and its associated water flows. In this arid area, however, karst (Cape Range) and calcretes (Pilbara) often constitute the principal water supply for human activities. We need to recognise that surface operations (sealing or clearing) as well as those below ground (water abstraction, mine dewatering) have considerable potential to hazard these ancient relictual communities.* (Humphreys, 1999; p. 224).

Unfortunately, WA is unusually thirsty as well as arid. Heavy farm, industrial and mining water use is matched by heavy domestic use. According to the Australian Bureau of Statistics, a four-year audit (1993-1997) found that WA households used almost *twice* as much water as did households in Tasmania: 320 kl/yr *vs.* 176 kl/yr.

Let's hope that Anaconda follows up their discovery with an invertebrate survey of their 'sea', and that in future, resource assessments of Australia's groundwaters take note of their hidden biodiversity.

More information:

Humphreys, W.F. 1999. Relict stygofaunas living in sea salt, karst and calcrete habitats in arid northwestern Australia contain many ancient lineages. Pp. 219-227 *in* Ponder, W. and Lunney, D. (eds.), *The Other 99%. The Conservation and Biodiversity of Invertebrates. Transactions of the Royal Zoological Society of New South Wales*. Mosman: Royal Zoological Society of New South Wales.

Bradbury, J.H. and Williams, W.D. 1997. Amphipod (Crustacea) diversity in underground waters in Australia: an Aladdin's cave. *Memoirs of the Museum of Victoria* 56: 513-519.

A book of jewels

Tasmania's magnificently coloured jewel beetles are to be featured in a book by David Cowie. Each of *ca.* 50 species will be illustrated with a colour photograph and a distribution map. The jewel beetle book is being produced by the Tasmanian Field Naturalists Club Inc., which published the beautifully illustrated *Butterflies of Tasmania* in 1994. For more information, please contact the project leader, Don Hird, c/- TFNC, GPO Box 68A, Hobart TAS 7001.